Poliomyelitis Vaccine A Review

BY

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As polio vaccine becomes available to new areas there are many questions that arise, not only because of its newness, but because of the continual experimentation resulting in more concrete conclusions. Questions from lay people are frequent and often show concern as a result of rumours or reports that are not clear. It behoves the physician to try to understand the essential points as they now exist, even though they may change in the future.

Types of Vaccine

The vaccine now in wide use is a formalised (killed virus) anti-poliomyelitis vaccine.[1-2] This destruction of the infectivity of the polio virus is an orderly chemical process, and when properly carried out results in a relatively predictable effect.[1]

Some "accidents" (cases of polio evidently resulting from use of one commercial preparation),[6] caused the producers to alter the preparation. Essentially this alteration was further filtration to remove all particles that might protect the virus. It was feared that the vaccine, while safer, might not have antigenic activity.[6] However, further studies have shown that the safer vaccine was also effective. It has been shown that it is not necessary to use infective virus to stimulate naturally acquired immunity. Furthermore, commercially produced vaccines can and have produced immunity.[1]

Actually the indications are that immunity to paralysis is mediated not only through existing antibody, but through immunological hyperactivity that calls forth antibodies sufficiently rapidly, after exposure, to intercept invasion of the C.N.S., even though pharyngeal or intestinal infections have occurred.[1] Therefore the actual amount of antibody or hyperactivity required by measure for protection is not actually known.

A virus neutralising test[7] has been used to assess the ability of a patient's serum, when mixed with virus, to prevent infection of tissue culture by the virus. The resulting titres indicated that in general a single injection of the killed virus vaccine did not result in demonstrable antibodies, but that the second did. Those getting three injections responded with increasing neutralising antibodies.

Various studies have established beyond doubt that immunisation of humans by the oral route of administration, using attenuated live virus, not only is possible, but has been successfully accomplished.[3] The possibility of the inoculation of killed vaccine, followed later by the feeding of live attenuated virus, is for future consideration.[2]

The present technique of preparing the killed polio vaccine has led the way to what seem to be effective vaccines, using other types of virus.[8-9]

Indications

In areas rarely penetrated by the virus, such as the Arctic, all the population is susceptible and should be vaccinated. In other areas of heavy infections, such as North Africa and the Middle East, almost everyone over five years is immune, and immunisation is indicated mostly for those under six years of age. However, most areas fall in between these two extremes. Even within an area there is considerable variation of immunity, as poor living conditions seem to encourage the natural production of immune antibodies.[2-5]

Young parents run an extra risk, probably from exposure from their children. This is especially true of the age group of 18-30. Mothers are more heavily exposed to their children, and pregnant women have an increased susceptibility.[2-4]

Therefore the primary indications for polio vaccination in the average, though variable, population would at least include young parents in the early priority as well as children over one year of age.

The use of the vaccine may also be indicated in epidemic conditions, where a neighbourhood (excluding intimate contacts) may be vaccinated. (See contraindications.) All persons frequently exposed, such as nurses and doctors, should be vaccinated.

Contraindications

The contraindications are much the same as for most vaccines, namely:—

(1) Any person with an acute major illness.

(2) Any person exhibiting symptoms of minor illness, especially fever, sore throat or gastro-intestinal upset.

(3) Any person known to be intimately exposed. While vaccination would probably do no harm, it would be too late, as seven to ten days are required to get even a response from the first injection, while at the same time the natural immunity antibody will be in production. The neighbourhood is quite a different matter. Immediate vaccination of all but those already infected or in close contact with households infected is indicated.

(4) Any person infected. The vaccine is of no value in the treatment of polio. There is no evidence that vaccination should be withheld during epidemics or during the polio season. Mass vaccination under epidemic conditions has been carried out without untoward reactions or provocation.[4-5]

It is of course advisable to have the vaccination completed before the polio season, in order to be protected.

Duration of Antibody Response

While only time will answer this question, it has been shown that antibodies are still present after three years. The effects of non-paralytic polio on continued immunity are a factor.[1-5] Continued immunity may be the result of repeated exposure rather than to the vaccine alone.[2]

Route of Administration

Intermuscular injection effects a somewhat higher antibody response than subcutaneous or a smaller intradermal injection.[5]

Dosage and Schedule

While there is some variation, the three 1 c.c. dose schedule is quite effective and satisfactory, though other schedules may be used.

Two 1 c.c. injections, spaced two to four weeks apart, with a 1 c.c. booster after seven months, are used more or less routinely. The primary purpose of the first injection is to sensitise the individual so that the third injection can result in the desired antibody response. The second injection is primarily to ensure a sensitising dose, as some (up to 20 per cent.) fail to become sensitised to the initial injection.[1-5] Either the second or the third injection may be delayed if necessary for six months or more (up to a year) and still be effective, though the immunity may be delayed.[1-5]

Reactions

Local and systemic reactions are mild and infrequent. There may be some erythema and tenderness at the site of injection, with moderate soreness of the extremity, for 24 to 36 hours. General malaise and low-grade fever of mild degree and short duration are observed occasionally.

No anaphylactic-like or other serious major reactions have been reported. Patients with known penicillin sensitivity have been immunised without ill effect. However, highly allergic individuals should be tested cautiously with very small initial doses of the vaccine given intradermally.

Safety

A vaccine against polio, to be practical, must not be attended by any risk that would tend to discourage its use. In preliminary studies, and in field trials, it was established that antibody production and immunity can be induced without risk of inducing paralysis. This has been reaffirmed in an accumulating experience in the United States and other countries. It is now clear that this vaccination procedure does not necessarily possess an inherent risk, and this is true regardless of the nature of the strains of virus employed.[1-5] This safety is true throughout the year. (See contraindications.)

Epidemiology

There is no evidence that vaccinated individuals can transmit the disease. This is consistent with the use of a killed virus. Only persons already or later infected could transmit the disease.[5]

Summary

While the technique, type of vaccine, dosage, etc., now in use may not be the final answer to polio, it is quite clear that the present vaccine has made great strides in preventing paralytic polio. The present widely used vaccine, employing formalised (killed) polio virus, has been found to (1) be effective; (2) be as safe as any biological product can be; and (3) have essentially the same contraindications as for any other vaccine.

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